ANSI C136.2-1996
(Revision of ANSI C136.2-1985)

American National Standard for Roadway Lighting Equipment—Luminaires Voltage Classification

Sponsor

Accredited Standards Committee on Roadway Lighting, C136

accredited by the

American National Standards Institute

Secretariat

The Institute of Electrical and Electronics Engineers, Inc.

Approved 16 July 1996

American National Standards Institute

Abstract: Three voltage classifications for luminaires used in roadway lighting are covered. General testing methods for determining the dielectric withstand and the transient voltage withstand are given. This standard applies to luminaire electrical insulation between ungrounded current-carrying members and noncurrent-carrying members that may be grounded by design or accident.
Keywords: lighting equipment, luminaires, roadway lighting equipment, voltage testing, withstand voltage testing

---

The Institute of Electrical and Electronics Engineers, Inc.
345 East 47th Street, New York, NY 10017-2394, USA

Copyright © 1996 by the Institute of Electrical and Electronics Engineers, Inc.
All rights reserved. Published 1996. Printed in the United States of America.

ISBN 1-55937-779-8

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Copyright The Institute of Electrical and Electronics Engineers, Inc.
Provided by IHS under license with IEEE
No reproduction or networking permitted without license from IHS

Not for Resale

IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Board. Members of the committees serve voluntarily and without compensation. They are not necessarily members of the Institute. The standards developed within IEEE represent a consensus of the broad expertise on the subject within the Institute as well as those activities outside of IEEE that have expressed an interest in participating in the development of the standard.

Use of an IEEE Standard is wholly voluntary. The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE Standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard. Every IEEE Standard is subjected to review at least every five years for revision or reaffirmation. When a document is more than five years old and has not been reaffirmed, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE Standard.

Comments for revision of IEEE Standards are welcome from any interested party, regardless of membership affiliation with IEEE. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments.

Interpretations: Occasionally questions may arise regarding the meaning of portions of standards as they relate to specific applications. When the need for interpretations is brought to the attention of IEEE, the Institute will initiate action to prepare appropriate responses. Since IEEE Standards represent a consensus of all concerned interests, it is important to ensure that any interpretation has also received the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to interpretation requests except in those cases where the matter has previously received formal consideration.

Comments on standards and requests for interpretations should be addressed to:

Secretary, IEEE Standards Board
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331
USA

Note: Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. The IEEE shall not be responsible for identifying all patents for which a license may be required by an IEEE standard or for conducting inquiries into the legal validity or scope of those patents that are brought to its attention.

Authorization to photocopy portions of any individual standard for internal or personal use is granted by the Institute of Electrical and Electronics Engineers, Inc., provided that the appropriate fee is paid to Copyright Clearance Center. To arrange for payment of licensing fee, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; (508) 750-8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Copyright The Institute of Electrical and Electronics Engineers, Inc.
Provided by IHS under license with IEEE
No reproduction or networking permitted without license from IHS
Not for Resale

Introduction

(This introduction is not a part of ANSI C136.2-1996, American National Standard for Roadway Lighting Equipment—Luminaires Voltage Classification.)

The Accredited Standards Committee on Roadway Lighting, C136, had the following voting members at the time this standard was approved:

Richard E. Hildreth, *Chair* **Rosemary Tennis,** *Staff Liaison*

Organization Represented	*Name of Representative*
Alabama Power Company	Scott Thurman
American National Standards Institute	Frank M. Alverson
Area Lighting Research, Inc.	George Duve
CEW Lighting, Inc.	Dan Pitcher
Cooper Lighting	Richard Snow
Dark to Light, Inc.	Jeff D. Walters
Duke Power Company	Stokes White
Detroit Edison Company	Donald Edwards
Edison Electric Institute	William A. Maguire Gary N. Miller (*Alt.*)
Fisher-Pierce Corporation	Robert Broadbent
General Electric Company	James A. Havard
Georgia Power Company	Mike Stevens
Hapco	Thomas M. Fawley
Holophane Lighting Company	Robert Catone
Hubbell, Inc.	Thomas D. Hirt
Illuminating Engineering Society	Richard E. Stark
Institute of Electrical and Electronics Engineers, Inc.	Andrew S. Kosiorek
Lampas Controls, Inc.	Vance Spillman
Los Angeles Bureau of Street Lighting	Philip H. Reed
Memphis Light, Gas and Water Division	Robert E. Beanblossom
National Electrical Contractors Association	H. Brooke Stauffer
Penn Power and Light Company	Gerald S. LaBar
Ripley Photocontrol	John Mills
Shakespeare, Inc.	William D. Griffin

Copyright The Institute of Electrical and Electronics Engineers, Inc.
Provided by IHS under license with IEEE
No reproduction or networking permitted without license from IHS
Not for Resale

Sherman Utility Structures ..... Ricky Miskelley

Thomas & Betts Corporation ..... Greg Steinman

Union Metal Corporation ..... Tom Michaels

Valmont Industries ..... Dennis Havranek

Virginia Power ..... Frank I. Hinkle

W. J. Whatley, Inc. ..... George Maybee

Wisconsin Department of Transportation ..... Balu Ananthanarayanan

Wisconsin Electric Power ..... Richard G. Monsoor

Members-at-Large ..... Richard E. Hildreth

Mary Lynne Nielsen
IEEE Standards Project Editor

--`,-`-`,,`,,`,`,,`---
Copyright The Institute of Electrical and Electronics Engineers, Inc.
Provided by IHS under license with IEEE
No reproduction or networking permitted without license from IHS
Not for Resale

Contents

CLAUSE PAGE

1. Overview 1

2. References 1

3. Voltage classification 2

3.1 General 2
3.2 Luminaires—250 V class 2
3.3 Luminaires—600 V class 2
3.4 Luminaires—5000 V class 2

4. Scope of tests 2

5. Dielectric withstand tests 3

6. Transient voltage withstand test 3

6.1 Basic insulation (BIL) test 3
6.2 Surge test 4

Copyright The Institute of Electrical and Electronics Engineers, Inc.
Provided by IHS under license with IEEE
No reproduction or networking permitted without license from IHS
Not for Resale

Copyright The Institute of Electrical and Electronics Engineers, Inc.
Provided by IHS under license with IEEE
No reproduction or networking permitted without license from IHS
Not for Resale

American National Standard for Roadway Lighting Equipment—Luminaires Voltage Classification

1. Overview

This standard covers three voltage classifications for luminaires used in roadway lighting.

It also covers the general testing methods for determining

a) Dielectric withstand
b) Transient voltage withstand

This standard applies to luminaire electrical insulation between ungrounded current-carrying members and noncurrent-carrying members that may be grounded by design or accident.

2. References

This standard shall be used in conjunction with the following standards. If the following standards are superseded by an approved revision, the revision shall apply.

ANSI C82.6-1985, American National Standard Reference Ballasts for High-Intensity-Discharge Lamps—Methods of Measurement.[1]

IEEE Std C62.41-1991, IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits (ANSI).[2]

IEEE Std 1313-1993, IEEE Standard for Power Systems—Insulation Coordination (ANSI).

[1]ANSI publications are available from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

[2]IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

Copyright The Institute of Electrical and Electronics Engineers, Inc.
Provided by IHS under license with IEEE
No reproduction or networking permitted without license from IHS
Not for Resale

3. Voltage classification

3.1 General

The electrical insulation of current-carrying members of luminaires covered by this standard shall be suitable for one of the 60 Hz voltage classifications given in the following list:

a) 250 V rms
b) 600 V rms
c) 5000 V rms

3.2 Luminaires—250 V class

Luminaires designed with this class of insulation are intended for use on protected multiple circuits operated under 250 V rms.

3.3 Luminaires—600 V class

Luminaires designed with this class of insulation are intended for use on multiple circuits operated under 600 V rms. They can also be used in the secondary circuit of series-insulating transformers, which develop an open-circuit voltage not exceeding a peak of 848.4 V (peak equivalent of 600 V rms).

3.4 Luminaires—5000 V class

Luminaires designed with this class of insulation are intended for use on series circuits supplied by

a) Constant-current transformers (or regulators), the secondaries of which will develop open-circuit voltages not in excess of 5000 V rms
b) Series-insulating transformers, the secondaries of which will develop open-circuit voltages not in excess of 5000 V rms

Table 1—Minimum withstand requirements

Voltage classification (rms)	60 Hz dielectric withstand test		Transient voltage withstand test	
	1 min dry (kV rms)	10 s wet (kV rms)	BIL full wave withstand test (kV peak)	Open-Circuit surge voltage (kV peak)
250	2.5	Not required	7.5	4.5
600	2.5	Not required	10.0	6.0
5000	19.0	12.0	30.0	25.0

4. Scope of tests

Insulation between current-carrying parts and potentially grounded noncurrent-carrying parts shall meet all of the test requirements described in this standard for the applicable voltage classification.

Copyright The Institute of Electrical and Electronics Engineers, Inc.
Provided by IHS under license with IEEE
No reproduction or networking permitted without license from IHS Not for Resale

The specified tests are design, not production, tests. They shall be made on at least one luminaire of each design.

5. Dielectric withstand tests

The test potential applied to the luminaire shall be supplied from a suitable testing transformer (hi-pot) with a capacity of at least 500 VA and a variable output voltage that is essentially sinusoidal. The applied potential shall be increased gradually from zero to the 60 Hz dielectric withstand test values shown in table 1 and shall be held at that level for 1 min. The ramp of the applied potential shall be substantially uniform and at a rapid rate consistent with the accurate response of the voltmeter used to measure the test voltage.

Dielectric withstand tests shall be made with the luminaire completely assembled and wired in the conventional manner.

Dielectric withstand tests shall be made with the luminaire heated to its normal operating temperature.

Dielectric withstand tests shall be made by applying the test potential between all input terminals tied together and the luminaire frame. In the case of any luminaire with an internal jumper between an input terminal and frame, this jumper shall be removed. Luminaires equipped with a photoelectric control receptacle shall be tested with a shorting cap in place of the photoelectric control.

The luminaire shall have passed the dielectric withstand test if no insulation breakdown occurred when the luminaire was subjected to the dielectric withstand voltages listed in table 1.

6. Transient voltage withstand test

Luminaires shall be tested for the transient voltage withstand capability of the luminaire insulation by one of two methods. If the luminaire is so designed that no voltage breakdown is expected to occur when the BIL voltages of table 1 are applied to the luminaire, then the test method in 6.1 shall be used. If the luminaire is designed with small electrical gaps or other types of surge protection between the input terminals and the luminaire frame, which will break down when subjected to the BIL voltages of table 1, then the test method in 6.2 shall be used.

6.1 Basic insulation (BIL) test

The BIL test shall be performed with the BIL full wave, which has a 1.2 × 50 μs wave shape, as described in IEEE Std C62.41-1991 and IEEE Std 1313-1993.[3] The test shall use the applicable BIL voltage with the peak amplitudes listed in table 1.

BIL tests shall be made with the luminaire completely assembled and wired in the conventional manner.

The BIL test shall be performed by applying the test potential between all input terminals tied together and the luminaire frame. In the case of any luminaire with an internal jumper between an input terminal and frame, this jumper shall be removed. Luminaires equipped with a photoelectric control receptacle shall be tested with a shorting cap in place of the photoelectric control. If a nonlocking type (button) photocontrol is used, the photocontrol line and load terminals shall be shorted.

The luminaire shall have passed the BIL test if no solid insulation breakdown occurred when the luminaire was subjected to the basic voltages (BIL voltages) listed in table 1.

[3]Information about references can be found in clause 2.

Copyright The Institute of Electrical and Electronics Engineers, Inc.
Provided by IHS under license with IEEE
No reproduction or networking permitted without license from IHS
Not for Resale

6.2 Surge test

6.2.1 Characteristics of surge

The surge test shall employ a surge with the following characteristics. The open-circuit surge voltage shall have the applicable peak amplitude listed on table 1 and a 1.2 × 50 μs wave shape. The voltage wave shall be synchronized with the ac power line and shall be initiated 30° to 60° or 255° to 285° after the instantaneous 60 Hz voltage has changed from negative to positive polarity. Positive voltage polarity is defined to be the same polarity as the surge voltage. The short-circuit surge current shall have a 3000 A peak amplitude and an 8 × 20 μs wave shape. The minimum available follow current shall be 1000 A rms and have a minimum duration of 1 cycle.

6.2.2 Test equipment calibration

The test equipment shall be calibrated without connecting the luminaire to the surge equipment. The follow current shall be measured by shorting the line and ground output test points of the surge equipment. The back filter shall be connected when determining the follow current. The open-circuit surge voltage shall be measured between the line and ground surge equipment test points, with the back filter and ac power line connected. The short-circuit surge current shall be determined by shorting the line and ground test points. The ac power lines and back filter shall not be connected for the short-circuit surge current measurement.

6.2.3 Test procedure

The test procedure shall be performed after the test equipment has been calibrated according to 6.2.2 to give the values specified in 6.2.1. The luminaire input terminals shall be tied together and connected to the surge equipment line output test point with leads 6 in long. The luminaire frame shall be connected to the surge equipment ground test point with leads 6 in long. Four surges as specified in 6.2.1 with a phase angle of 30° to 60° shall be applied to the luminaire, followed by two surges with a phase angle of 225° to 285°. The minimum time between surges shall be 15 min.

Luminaires equipped with a photoelectric control receptacle shall be tested with a shorting cap in place of the photoelectric control.

6.2.4 Results of test

The luminaire shall start and operate in its intended manner after having been subjected to the surge test described in 6.2.3.

Copyright The Institute of Electrical and Electronics Engineers, Inc.
Provided by IHS under license with IEEE
No reproduction or networking permitted without license from IHS
Not for Resale